GIFTS: Quick Assessment of Course Topics' Impact in First-Year Engineering Seminars

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Introduction

This GIFTS paper discusses a survey-based method to rapidly gain insight into the impact of different course topics on students, which is useful for courses with many topics to cover.

It is not uncommon for first-year engineering classes or seminars to cover a variety of topics, which could include student success material, technical content, and introductions to various engineering majors, concentrations, or fields of practice [1, 2]. The first-year seminar at Campbell University covers fifteen topics across in a one-semester, one-credit, 1.5 weekly-contact-hour course. The two main themes of the topics are student success and professional preparation.

With many different topics presented, sometimes by parties who are not the course instructors, it is not always obvious which topics should be prioritized for improvement or replacement. In the case of Campbell University's first-year seminar, student feedback in late-semester reflections indicated that all fifteen topics were meaningful and important to at least some students.

Methods

A Qualtrics survey was developed where students ranked, in order of impact on them personally, each of the course topics. The only prompt for the survey is "Please order the class topics / sessions in terms of their impact or importance to you, with the most impactful or important class topics first and less impactful or important topics / sessions at the bottom." The survey shows the fifteen topics in random order, and participants can drag-and-drop topics to set their rankings.

If random order was not used, it is likely that incomplete surveys would affect the results (by promoting the ranking of earlier items). However, this also makes it difficult to identify incomplete surveys. No method in Qualtrics was found to measure the number of topics that students moved between ranks while completing the survey, which would offer a way to assess data quality. However, responses with very low time spent on the survey can be discarded.

The survey was conducted in-class on the final day of each course as an optional, ungraded activity, and took about five minutes total. The median survey completion time was two minutes and twenty-five seconds. The survey was distributed using a link posted to the course website as well as a QR code on displays and was completed by students on their personal devices. The survey was anonymous. Using the methods discussed in [3] the results can be scaled against each other to show the relative overall impact on students of the various topics. This method yields a score between 0 and 1, with the highest ranked topic getting a 1 and other topics scoring the proportion of the highest ranked topic's performance they achieved.

This survey and analysis have at least two important limitations. First, requiring the topics to be ranked rather than individually evaluated does not allow for evaluation of the difference between

ranks – there could be a large drop in impact on a given participant between the third and fourth ranked item, or not. The data will not indicate either way. The upside is speed of measurement. Second, the existing survey is that it does not currently ask students to assess whether class topics were worthwhile, just their relative impact. The assumption, which has qualitative support from summative student reflections about the course, is that the most impactful topics for a given student were worthwhile, and some topics that were least impactful for that student may not have been worth it for them. The author will consider adding a ranking item to the next survey along the lines of 'Topics below this ranking I did not consider worth the time'. This may yield additional insights and others who are considering this method may wish to implement it.

Results & Discussion

In Fall 2023, 46 of 52 (88.5%) and in Fall 2024, 50 of 62 (80.6%) students completed the survey. Data from three additional 2024 responses was discarded for low survey engagement time. These response rates show that students were willing to engage in this optional, ungraded activity on the final day of class and additional incentives were not required in this context. Note that some students skipped on the final day of these classes, which lowered response rates.

Results from the Fall 2023 and Fall 2024 course offerings are shown in Table 1, with the relative impact, the change (or delta, Δ) across the two course offerings, the overall ranking of each topic's impact, and the change in the ranking across the two course offerings shown.

Table 1. Class Topic Impact Findings & Changes in Rank from 2023 to 2024

Class Topic	Impact		Impact Δ	Rank		Rank Δ
	2023	2024	23-24	2023	2024	23-24
Week 9 - Self and Time Management	1.00	1.00	0.00	1	1	0
Week 8 - Stress Management and Mid-term Check-in	0.74	0.71	-0.03	2	2	0
Week 6 - Learning Science & Strategy	0.65	0.63	-0.02	3	4	1
Week 7 - Academic Career Planning & Advising Prep.	0.62	0.66	0.04	4	3	-1
Week 10 - Professional Communications	0.60	0.58	-0.02	5	7	2
Week 11 - Professional Ethics	0.58	0.59	0.01	6	5	-1
Week 3 - Lifelong Learning and Professional Organizations	0.55	0.53	-0.02	7	10	3
Week 1.5 - Engr. Techniques for Success (Night event)	0.54	0.55	0.01	8	9	1
Week 12 - Personal and Professional Values in Engineering	0.53	0.59	0.06	9	6	-3
Week 4 - Academic Ethics	0.53	0.57	0.04	10	8	-2
Week 5 - Effective Teams & Valuing Diversity	0.46	0.44	-0.02	11	14	3
Week 0 - Tartan Engineer (Orientation)	0.44	0.46	0.02	12	12	0
Week 13 - Beauty, Elegance, and Self-Expression in Engr.	0.42	0.48	0.06	13	11	-2
Week 1 - Images of Engineering (What is Engineering?)	0.42	0.45	0.03	14	13	-1
Week 2 - What Does a [University Name] Education Mean	0.37	0.37	0.00	15	15	0

A few large changes are observed in scores and rankings across cohorts. For example, Week 12 climbed three ranks year to year – with causes being unclear but potentially including cohort

effects and variation in instructor delivery despite the class being taught by the same instructor using the same materials. However, most topics saw minimal or no changes in impact ranking year-to-year, suggesting some durability of results across cohorts.

One result is that course topics focused on academic success rank highly. Week 9's content on time management methods does extraordinarily well. This ranking may not generalize to other institutions serving different student bodies, but it is an example of a topic's standout impact that was not previously clear to the instructional team. This ranking motivates review of that topic's content and pedagogy to search for improvements to apply to other topics or the course overall.

It is also useful to see that Week 2's content is rated least impactful in both surveys. Week 2 is primarily presented by non-Engineering personnel to meet University-level requirements for 100-level courses. The ranking data may be useful in conversations about potential enhancements to that class session. Rankings collected at other institutions could be similarly useful in discussing areas that have the most room to increase their impact on students.

The data collected can also be examined to check for topics that were ranked lower impact but were meaningful to a subset of students. Table 2 shows the number of students who marked a specific topic as their first rank choice and in their top three rankings for personal impact.

Table 2. Class Topics' Top Ranking and Top Three Ranking Counts

Week	9	8	6	7	0	10	11	1.5	3	4	13	2	12	5	1
2023 Top 3	26	19	13	12	11	8	8	6	6	6	6	5	5	4	3
2023 Top 1	15	5	1	1	7	0	2	2	3	1	3	2	2	1	1
2024 Top 3	28	13	14	15	11	7	11	13	6	7	7	1	10	1	6
2024 Top 1	11	2	6	5	8	1	3	5	2	1	3	0	1	0	2

Some topics with lower overall rankings have a subgroup of students who rate them as notably impactful. For example, Week 4's topic of Academic Ethics had 13 students with it in their top 3 most impactful classes across the 96 respondents (Table 2) despite that topic ranking 10th in 2023 and 8th in 2024 overall (Table 1). This aligns with prior experience from student reflections about the course (written and class discussions) which showed all course topics being impactful for some students. It is unrealistic for all class topics to be equally impactful for all students and the needs of smaller groups of students currently well-served by a course would ideally still be met after any changes.

Summary

A five-minute survey asking first-year engineering students to rank the relative impact of different class topics yielded useful and sometimes previously unknown-to-course-faculty information upon basic analysis. Review of data from two course offerings shows stability in results between course administrations. The rankings of topics from Campbell University should not be assumed to apply to other contexts. Others involved with preparing first-year engineering courses may benefit from the use of a similar survey and analysis in their own context to inform changes and improvements in course content and delivery.

[1] K. Reid, D. Reeping and E. Spingola, "A Taxonomy for Introduction to Engineering Courses," *International Journal of Engineering Education,* vol. 34, pp. 2–19.

[2] M. Vigeant, K. Marosi and R. Ziemian, "Evaluating the seminar model for first year engineering education," in *2007 Annual Conference & Exposition,* 2007.

[3] L. K. Rynearson, "GIFTS: Activities for exploring beauty and elegance in engineering in a first-year seminar," in *2024 ASEE Annual Conference & Exposition,* 2024.